Studying SNRs and their environment with high-resolution radio spectral index maps

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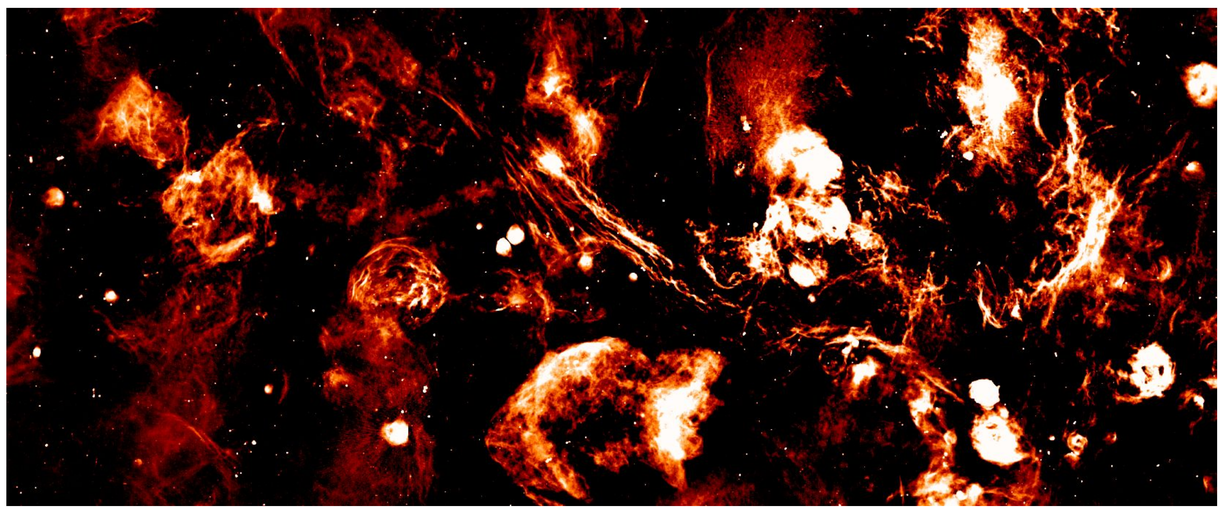


The SARAO MeerKAT Galactic Plane Survey (SMGPS; Goedhart et al. 2024) covers three quadrants of our Galaxy ($250° < l < 60°$, $b < |1°|$) at a frequency of 1.3 GHz (*L*-band) and with a resolution of 8 arcsec. A $1° \times 2°$ tile centered at $l = 312°$ is shown on the left.

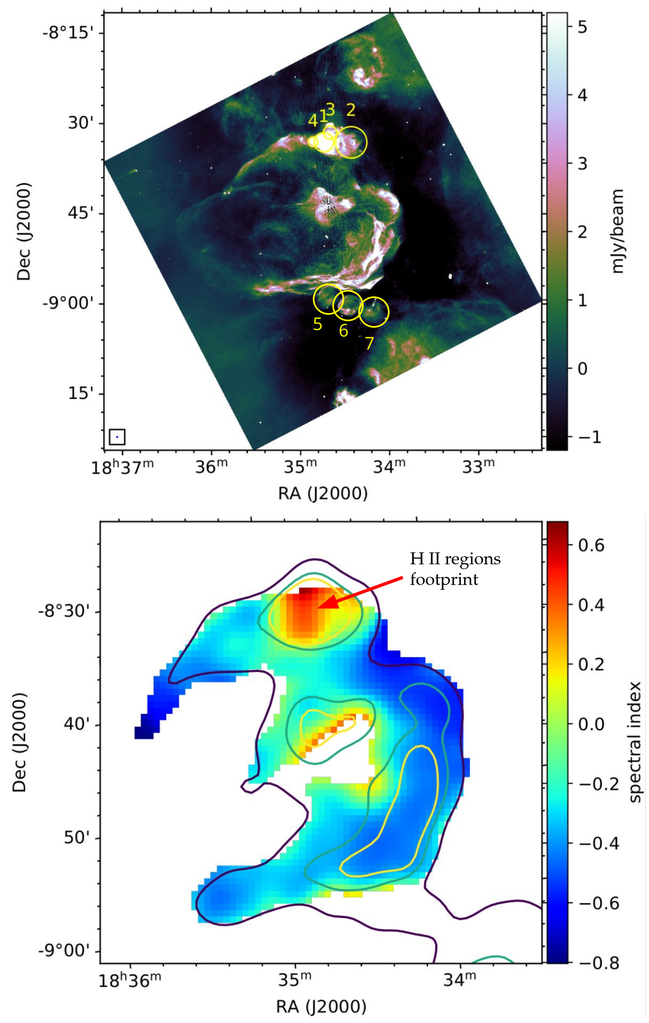
A complex environment

A preliminary analysis of the SMGPS data is showing that many supernova remnants are surrounded by discrete H II regions and by more diffuse ionized medium. A possible scenario is that star formation has been triggered by the supernova progenitor or by the remnant itself.

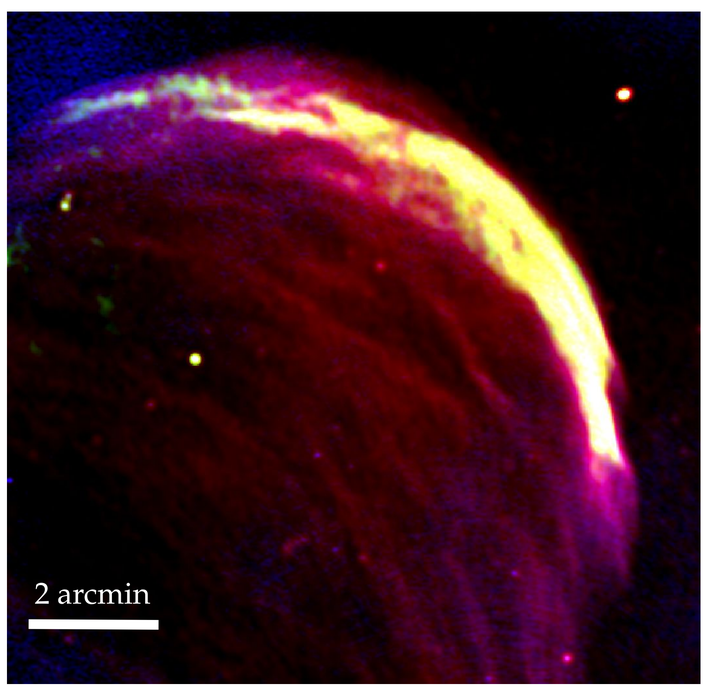
MWA-MeerKAT spectral analysis

A detailed radio spectral index analysis can disentangle the different spectral regimes that characterize the emission at centimeter wavelengths.

Confused in the brightness map, SNRs and H II regions can easily be distinguished thanks to their different spectral index (Loru et al. *submitted*, and see Sara's talk).



MeerKAT image (top) and MWA-MeerKAT spectral index map (bottom) of SNR G023.3-0.3 (Loru et al., *submitted*). At least 7 H II regions are detected close to or within the SNR (yellow circles).



Composite RGB MeerKAT image of SNR G327.4+01.0: red 1.3 GHz (SMGPS), green 2.6 GHz and blue 3.1 GHz (MK project SCI-20230907-CB-02 , PI C. Buemi).

Data processing and arcsec spectral index maps

Spectral index maps with arcsecond resolution can reveal small-scale variations of the spectral index and allow a detailed study of filamentary structures and of the SNR edges.

We are reprocessing SMGPS data at 1.3 GHz in order to obtain in-band spectral indices. This is a computational demanding task that is performed only on selected fields.

Follow-up observations with MeerKAT *S*-band are complementary to this approach, supplying, when combined with *L*-band, even more accurate arcsec spectral index maps (given the wider frequency range).

MeerKAT+ *S*-band legacy survey

A new all-sky (dec < -40°) *S*-band survey is planned for 2025 with MeerKAT+, an extension of MeerKAT with 13 SKA-compliant antennas added. This survey, a MPI+SARAO+INAF joint project, is going to provide images at a resolution of 2-3 arcsec and with a sensitivity better than 20 μJy/beam. Both Stokes-*I* and polarization images will be produced. This survey represents a great opportunity to study southern SNRs, including remnants at high Galactic latitude, usually uncovered by pure Galactic surveys. For more information on this survey, please contact me (adriano.ingallinera@inaf.it, national coordinator for INAF).